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(54) **EDGEWISE WOUND COIL MANUFACTURING DEVICE**

(75) Inventors: **Kazuyuki Yamaguchi**, Kariya (JP); **Takuya Hasegawa**, Kariya (JP)

(73) Assignee: **KABUSHIKI KAISHA TOYOTA JIDOSHOKKI**, Aichi-ken (JP)

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H01F 41/06 (2006.01)

(52) **U.S. Cl.**
CPC ***H01F 41/0612*** (2013.01); ***H01F 41/0633*** (2013.01)

(58) **Field of Classification Search**
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See application file for complete search history.

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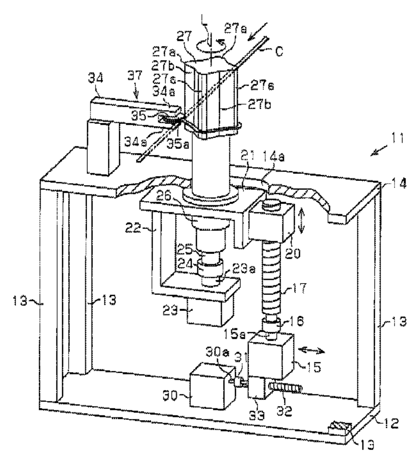
Primary Examiner — Debra Sullivan
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

Disclosed is an edgewise wound coil manufacturing device for manufacturing an edgewise wound coil. The edgewise wound coil manufacturing device is provided with: a plurality of corners; a core having a recess formed between each pair of adjacent corners, and around which a flat wire is wrapped; a rotating part that forces the core to rotate around the central axis of the core; guide parts that hold the flat wire therebetween in the thickness direction, while guiding the flat wire in such a manner that the flat wire wraps around the core; a first moving part that forces at least one of the guide parts and the core to move in the approaching/receding direction of the other; and a controller that adjusts the amount that the first moving part moves such that the edgewise wound coil achieves the desired shape.

5 Claims, 5 Drawing Sheets



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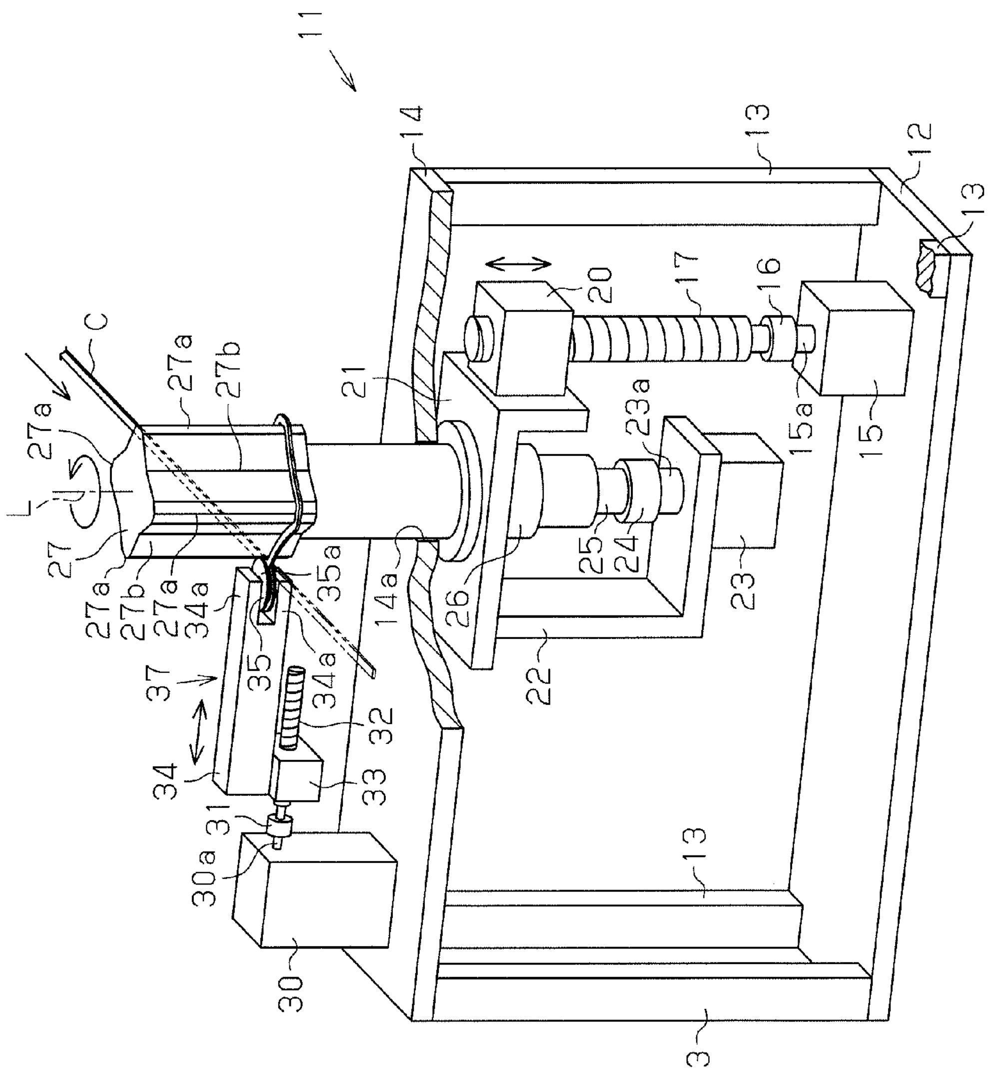
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Fig.1

Fig.2

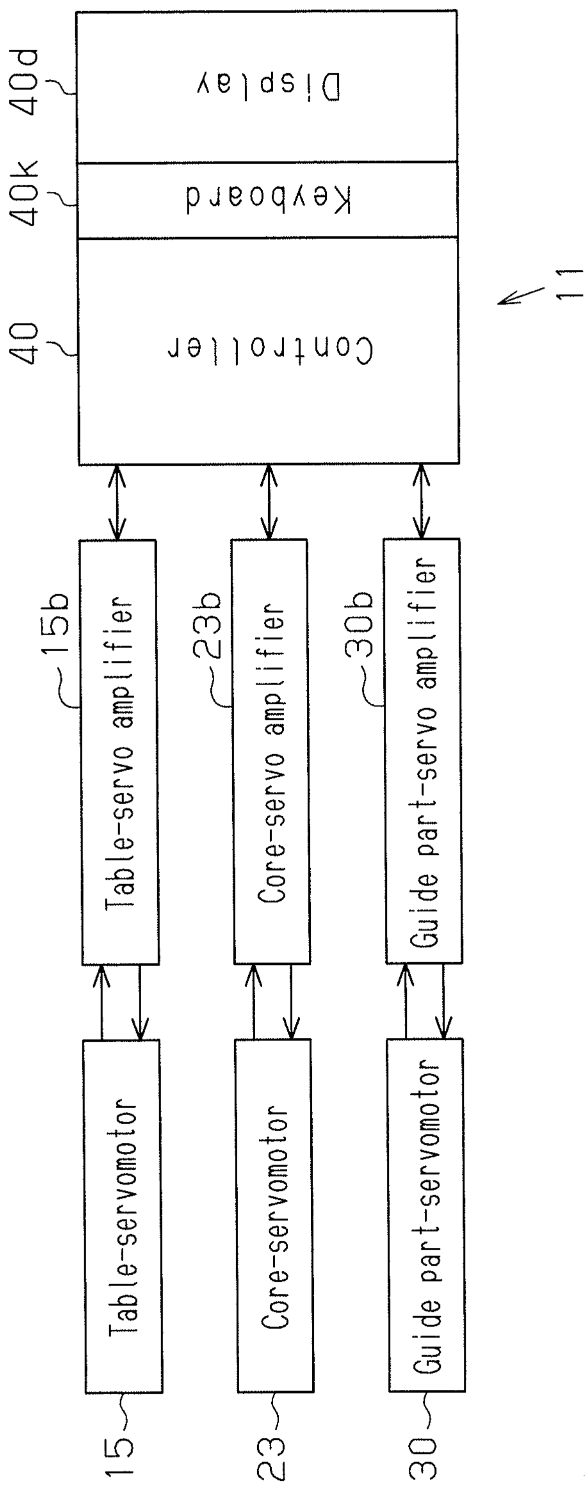

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Table-servo amplifier
Core-servo amplifier
Guide part-servo amplifier
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Table-servomotor
Core-servomotor
Guide part-servomotor
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Fig.3(a)

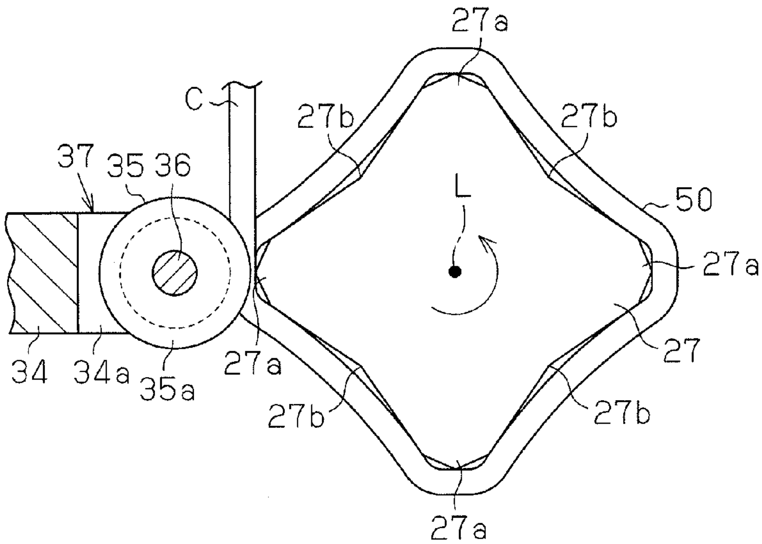


Fig.3(b)

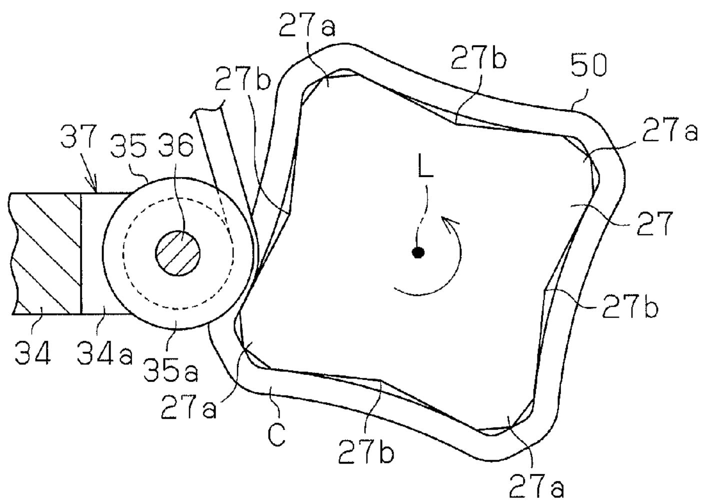


Fig.3(c)

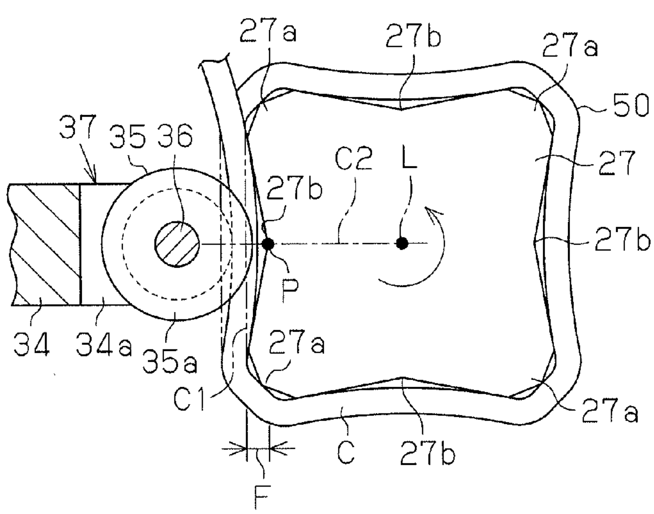


Fig.4

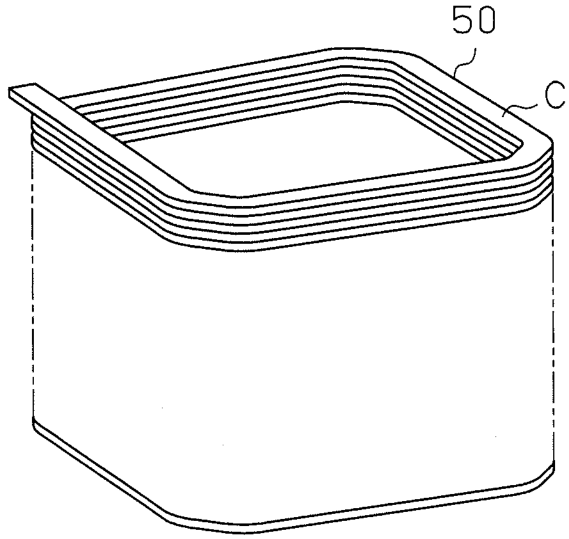


Fig.5

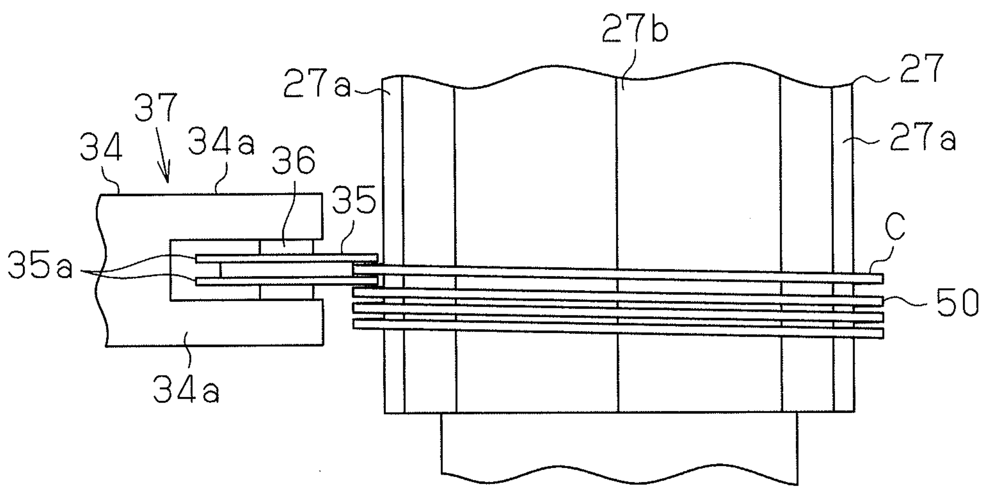
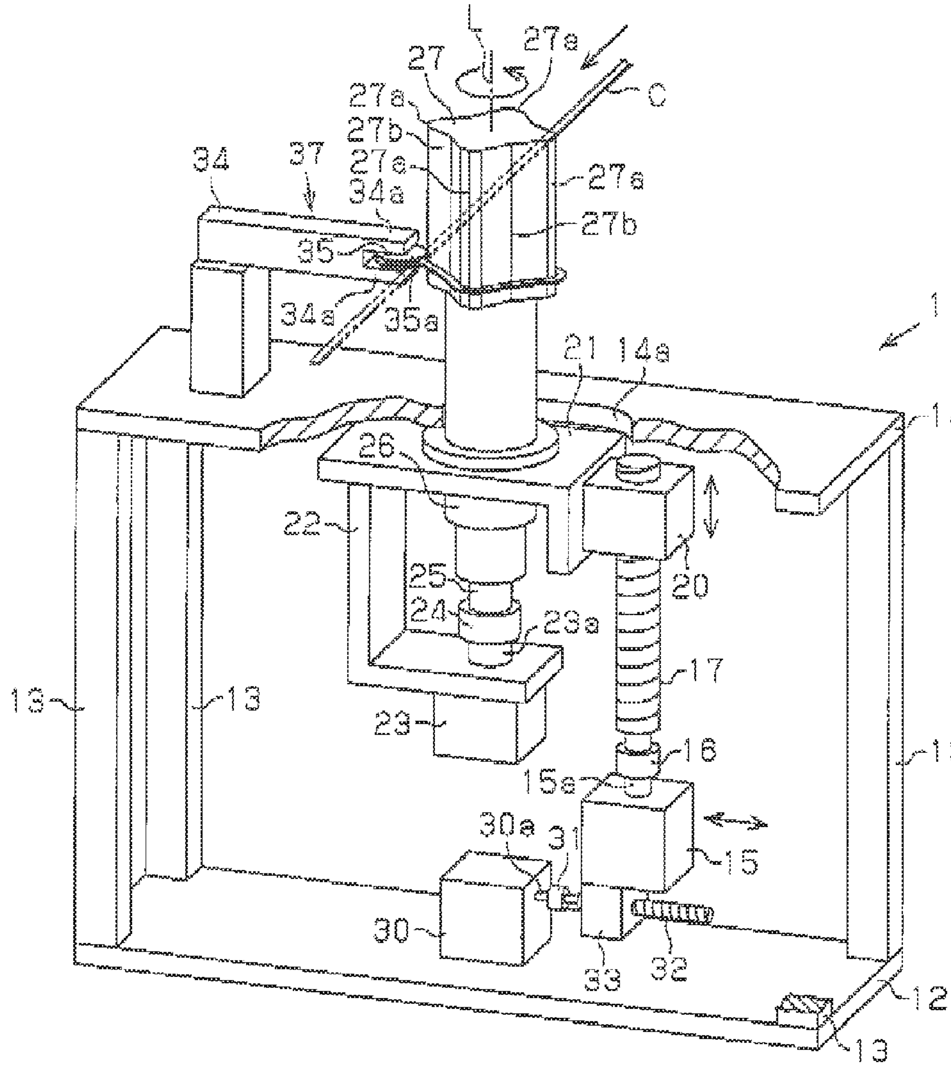


Fig.6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EDGEWISE WOUND COIL MANUFACTURING DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a National Stage of International Application No. PCT/JP2011/062945 filed Jun. 6, 2011, claiming priority based on Japanese Patent Application No. 2010-137580 filed Jun. 16, 2010, the contents of all of which are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates to an edgewise wound coil manufacturing device for manufacturing an edgewise wound coil.

BACKGROUND OF THE INVENTION

An edgewise wound coil formed by winding a flat wire is manufactured, for example, using a magnetic field coil manufacturing device disclosed in Patent Document 1. The manufacturing device disclosed in Patent Document 1 includes a core around which a flat wire is wound, a first driving part for rotating the core, a guide for guiding the flat wire when it is wound, a second driving part for pressing the guide against the core, a third driving part for moving the core or the guide in an axial direction of the core, and a base for movably supporting the first, second and third driving parts. According to this manufacturing device, the first driving part rotates the core, and the second driving part brings the guide into contact with the core. The flat wire is pressed against a surface of the core by the guide and the flat wire is wound around the core. Simultaneously, the third driving part moves the core or the guide in the axial direction of the core. Therefore, the flat wire is pressed against the surface of the core and in this state, the flat wire is helically wound. As a result, the edgewise wound coil formed by winding the flat wire in a cylindrical shape is manufactured.

An edgewise wound coil formed by winding the flat wire in a polygonal shape is also manufactured. To manufacture such an edgewise wound coil, a manufacturing method of a polygonal coil described in Patent Document 2 is employed, for example. The manufacturing method of Patent Document 2 uses a polygonal core, which has two opposed surfaces with recesses, and a pressure roller arranged to face the recesses of the core. The pressure roller is pressed against the core by a spring or a hydraulic system.

When the coil is formed, a thin conductor (flat wire) is wound around the core while being pressed by the pressure roller against the core. At this time, portions of the thin conductor that corresponds to the recesses are depressed toward the core, and depressed parts of the coil are formed. When the core is pulled out of the coil, an edgewise wound coil formed by winding the thin conductor in a polygonal shape is manufactured. In the manufacturing method of Patent Document 2, since the depressed parts of the coil cancel or compensate for swells of the coil, which are generated after the core is pulled out, a coil is manufactured in which its straight part between angle portions of the coil extends in a straight manner.

PRIOR ART DOCUMENT

Patent Document

Patent Document 1: Japanese Laid-Open Patent Publication No. 2006-269715

Patent Document 2: Japanese Laid-Open Patent Publication No. 58-173818

SUMMARY OF THE INVENTION

Problems that the Invention is to Solve

According to the manufacturing method of Patent Document 2, to cancel the swells of the straight part of the coil, the core is provided with the recesses, and the thin conductor is pressed against the core by the pressure roller such that the depressed parts are formed in the thin conductor along the recesses. The shape of the obtained coil follows the outside shape of the core. Hence, according to the manufacturing method of Patent Document 2, the shape of the obtained coil is determined by the shape of the core. However, since the material of the thin conductor slightly differs on a lot-by-lot basis, swell of the coil remains after the coil is pulled out in some cases, or the straight part is recessed because the swelling amount is small on the other hand in some cases. Hence, to manufacture a coil having a desired shape, it is necessary to change the depth of the recess in accordance with a factor of the material of the thin conductor when it is manufactured. Therefore, it is necessary to frequently replace the core.

Accordingly, it is an objective of the present invention to provide an edgewise wound coil manufacturing device capable of manufacturing a coil into a desired shape without frequently exchanging the coil.

Means for Solving the Problems

To achieve the foregoing object and in accordance with one aspect of the present invention, an edgewise wound coil manufacturing device for manufacturing an edgewise wound coil is provided. The edgewise wound coil manufacturing device includes a core, a rotating part, a guide part, a first moving part, and a controller. The core includes a plurality of angle portions and recesses each formed between each pair of the adjacent angle portions. A flat wire is wound around the core. The rotating part rotates the core around a center axis of the core. The guide part guides the flat wire such that the flat wire is wound along the core while sandwiching the flat wire in a thickness direction. The first moving part moves one of the guide part and the core in an approaching/receding direction with respect to the other one of the guide part and the core. The controller adjusts a moving amount of the first moving part such that the edgewise wound coil is formed into a desired shape.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view schematically showing an edgewise wound coil manufacturing device according to one embodiment of the present invention;

FIG. **2** is a block diagram schematically showing the electrical configuration of the edgewise wound coil manufacturing device shown in FIG. **1**;

FIG. **3**(*a*) is a schematic diagram showing a state where a guide part is located on an angle portion of a core in the edgewise wound coil manufacturing device;

FIG. **3**(*b*) is a schematic diagram showing a state where the guide part is located between the angle portion of the core and a deepest portion of a recess;

FIG. **3**(*c*) is a schematic diagram showing a state where the guide part is located on the deepest portion of the recess of the core;

FIG. **4** is a perspective view showing an edgewise wound coil; and

FIG. **5** is a partial diagram showing a state where guide part sandwich a flat wire in its thickness direction in the edgewise wound coil manufacturing device shown in FIG. **1**; and

FIG. **6** is a perspective view schematically showing an edgewise wound coil manufacturing device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

One embodiment according to the present invention will now be described with reference to FIGS. **1** to **5**.

As shown in FIG. **1**, a flat wire C is a coated copper wire having a rectangular cross section. In the following description, a short side direction of a cross section of the flat wire C intersecting the longitudinal direction thereof is referred to as a thickness direction, and a long side direction of the flat wire C is referred to as a width direction. As shown in FIG. **4**, an edgewise wound coil **50** is formed into a square tubular shape by helically winding the flat wire C such that it is superposed in the thickness direction while bending the flat wire C in the width direction.

As shown in FIG. **1**, an edgewise wound coil manufacturing device **11** (simply, manufacturing device **11**, hereinafter) includes a rectangular plate-shaped base **12**, support legs **13** standing on four corners of the base **12**, and a support stage **14** supported on these support legs **13**. A table-servomotor **15** is provided on the base **12**. A table-ball screw **17** is connected to a drive shaft **15***a* of the table-servomotor **15** through a connection member **16**. The table-ball screw **17** is driven and rotated by the table-servomotor **15**.

The table-ball screw **17** supports a table **21** through a table-converting mechanism **20**. The table-converting mechanism **20** converts rotating motion of the table-ball screw **17** into straight motion of the table **21** along the axis of the table-ball screw **17**. The table-servomotor **15** can rotate in the forward and reverse directions. The table **21** can be ascended or descended (moved) by controlling rotating directions of the table-servomotor **15**.

An L-shaped support arm **22** is connected to a lower surface of the table **21**. The support arm **22** extends downward from the lower surface of the table **21** and then extends laterally in parallel to the table **21**. A core-servomotor **23** as a rotating part is mounted on a lower portion of the support arm **22**. A drive shaft **23***a* of the core-servomotor **23** projects from the core-servomotor **23** toward the table **21**. A rotary shaft **25** is connected to the drive shaft **23***a* through a connection member **24**. The rotary shaft **25** is driven and rotated by the core-servomotor **23**. The rotary shaft **25** is rotationally supported by a bearing **26**, which penetrates the table **21**. A core **27** is fixed to a distal end of the rotary shaft **25**.

The core **27** will be described. As shown in FIGS. **1** and **3**, the core **27** is formed into a substantially square pillar shape. An extending direction of a center axis L of the core **27** is referred to as an axial direction of the core **27**. Four angle portions **27***a* of the core **27** are formed into obtuse angles. A recess **27***b* is formed in each of side surfaces of the core **27**. Each recess **27***b* is recessed from an adjacent pair of the angle portions **27***a* toward the center axis L of the core **27**. Each recess **27***b* has a maximum depth at a position corresponding to an intermediate point between the pair of adjacent angle portions **27***a*. As shown in FIG. **3**(*c*), a straight line connecting end edges of the adjacent angle portions **27***a* to each other is defined as an imaginary line C**1**, and a straight line that intersects the imaginary line C**1** at right angles and passes through the center axis L is defined as a straight line C**2**. A length from the imaginary line C**1** to a deepest portion P of the recess **27***b* along the straight line C**2** is defined as a depth F of the recess **27***b*.

As shown in FIG. **1**, the core **27** is fixed to a distal end of the rotary shaft **25** such that the core **27** rotates around the center axis L. A through hole **14***a* is formed in the support stage **14**. The rotary shaft **25** extends the through hole **14***a*. By controlling the rotating directions of the table-servomotor **15**, the core **27** can be ascended or descended along the center axis L through the table **21**.

A guide part-servomotor **30** is provided on the support stage **14**. A drive shaft **30***a* of the guide part-servomotor **30** projects from a side surface of the guide part-servomotor **30** toward the core **27**. A guide part-ball screw **32** is connected to the drive shaft **30***a* through a connection member **31**. The guide part-ball screw **32** is driven and rotated by the guide part-servomotor **30**. The guide part-ball screw **32** supports a support arm **34** through a guide part-converting mechanism **33**. The guide part-converting mechanism **33** converts rotating motion of the guide part-ball screw **32** into linear motion of the support arm **34** along the axis of the guide part-ball screw **32**. The guide part-servomotor **30** can rotate in the forward and reverse directions. By controlling rotating directions of the guide part-servomotor **30**, the support arm **34** can move in directions approaching and separating from the core **27**.

As shown in FIG. **5**, a pair of support pieces **34***a* is provided on the distal end of the support arm **34** (on the side of core **27**) such that the support pieces **34***a* are opposed to each other in the vertical direction at a distance from each other. The guide member **35** is supported by a support shaft **36** between the pair of support pieces **34***a*. The guide member **35** is provided with a pair of disk-shaped guide plates **35***a*, and the guide plates **35***a* guide the flat wire C in a sandwiching manner in the thickness direction. The guide plates **35***a* are opposed to each other at a distance from each other, and this distance is slightly greater than a thickness of the flat wire C. In this embodiment, the support arm **34**, the guide member **35** and the support shaft **36** form a guide part **37**. By controlling the rotating directions of the guide part-servomotor **30**, the guide part **37** (guide member **35**) can move in directions in which the guide part **37** (guide member **35**) and the core **27** approach and separate from each other (approaching/receding direction, hereinafter). In other words, the guide part **37** (guide member **35**) can move relative to the rotating core **27**. In the following description, the direction in which the guide part **37** approaches the core **27** is referred to as a deep side, and the direction in which the guide part **37** separates from the core **27** is referred to as an opening side.

Hence, in this embodiment, the guide part-servomotor **30** constitutes a first moving part, which moves the guide part **37** in the approaching/receding direction. As the table **21** is ascended or descended by the table-servomotor **15**, the core **27** ascends or descends (moves) with respect to the guide part **37**. Hence, the table-servomotor **15** constitutes a second moving part, which ascends or descends (moves) the core **27** along the center axis L.

A bobbin (not shown), around which the flat wire C is wound, and a feeding device (not shown), which feeds the flat wire C from the bobbin to the core **27** of the manufacturing device **11**, are located in the vicinity of the manufacturing device **11**.

Next, an electrical configuration of the manufacturing device **11** will be described. As shown in FIG. **2**, the manufacturing device **11** includes a controller **40**. The controller **40** includes a keyboard **40***k* for inputting various data by operator's operations, and a display **40***d*, on which various information is displayed. Information that is input through the keyboard **40***k* is displayed on the display **40***d*. The table-servomotor **15** is connected to the controller **40** through a table-servo amplifier **15***b*, and the core-servomotor **23** is also connected to the controller **40** through a core-servo amplifier **23***b*. The guide part-servomotor **30** is connected to the controller **40** through a guide part-servo amplifier **30***b*.

Information concerning the flat wire C such as the material thereof and time during which the flat wire C has been wound around the bobbin (not shown) is input to the controller **40** through the keyboard **40***k*. Further, information concerning the core **27** such as the length thereof in the axial direction and the depth F of the recess **27***b* is input to the controller **40** through the keyboard **40***k*. The controller **40** controls the guide part-servo amplifier **30***b* based on the input information concerning the flat wire C and the core **27**, thereby controlling the operation of the guide part-servomotor **30**. As a result, the moving amount of the guide part **37** (guide member **35**) with respect to the core **27** is controlled. By controlling the driving of the guide part-servomotor **30**, the guide member **35** can be moved in the approaching/receding direction.

The moving amount of the guide part **37** controlled by the controller **40** is set such that the flat wire C moves within a range smaller than the depth F of the recess **27***b*. In other words, the moving amount of the guide part **37** toward the deep side of the recess **27***b* is set such that an end edge of the flat wire C does not come into contact with the deepest portion P of the recess **27***b* in the side surface of the core **27**. The moving amount of the guide part **37** toward the opening side of the recess **27***b* is set such that a linear part of the obtained edgewise wound coil **50** does not swell. Further, the moving amount of the guide part **37** is appropriately adjusted within a range smaller than the depth F of the recess **27***b* in accordance with material and the like of the flat wire C. For example, when a flat wire C made of material that does not spring back almost at all is used, the moving amount of the guide part **37** is set such that the guide part **37** does not press the flat wire C toward the deep side of the recess **27***b* almost at all. When a flat wire C made of material that largely springs back is used, the moving amount of the guide part **37** is set such that the guide part **37** largely presses the flat wire C toward the deep side of the recess **27***b*.

By controlling the core-servo amplifier **23***b* based on information concerning the length of the core **27** in the axial direction, the controller **40** controls time during which the core-servomotor **23** is driven, i.e., time during which the core **27** is rotated. By controlling the table-servo amplifier **15***b* based on information concerning the length of the core **27** in the axial direction, the controller **40** controls time during which the table-servomotor **15** is operated, i.e., time during which the core **27** is ascended or descended.

Next, a manufacturing method of the edgewise wound coil **50** carried out by the manufacturing device **11** will be described.

Information concerning the core **27** such as the length of the core **27** in the axial direction, the depth F of the recess **27***b* and the angle of the angle portion **27***a*, the length between the pair of adjacent angle portions **27***a* is input into the controller **40** beforehand. Information concerning the flat wire C such as material of the flat wire C and winding time of the flat wire C around the bobbin is input into the controller **40** beforehand. Before the manufacturing device **11** is driven, the table **21** is moved upward to a position that is the closest to the support stage **14**, and a lower end of the core **27** is located at a position opposed to the guide member **35**.

When the manufacturing device **11** is turned ON, the controller **40** drives the core-servomotor **23** such that the core **27** rotates at a predetermined rotation speed through control of the core-servo amplifier **23***b*. The controller **40** drives the table-servomotor **15** such that the core **27** is moved downward at a predetermined lowering speed through control of the table-servo amplifier **15***b*. The controller **40** operates the guide part-servomotor **30** such that the guide member **35** moves in the approaching/receding direction along an outside shape of the core **27** through control of the guide part-servo amplifier **30***b*.

In other words, when the guide member **35** is opposed to the angle portion **27***a* of the core **27** as shown in FIG. **3**(*a*), the guide part **37** is moved by the guide part-servomotor **30** such that the flat wire C is bent along the angle portion **27***a*. When the guide member **35** is opposed to the recess **27***b* as shown in FIGS. **3**(*b*) and **3**(*c*), the guide part **37** is moved by the guide part-servomotor **30** such that the flat wire C extends along the recess **27***b*.

The controller **40** drives the guide part-servomotor **30** such that the guide member **35** moves by a predetermined moving amount with respect to the core **27** through control of the guide part-servo amplifier **30***b*. This moving amount is set such that in the edgewise wound coil **50** obtained by pulling out the core **27**, the flat wire C of the linear part does not swell and a swelling amount is small and the linear part is not recessed.

The controller **40** counts time required from the instant when the winding operation of the flat wire C around the core **27** is started to the instant when the winding operation is completed. If the flat wire C is wound around the entire core **27** in the axial direction, the operations of the core-servomotor **23** and the table-servomotor **15** are stopped. Then, the flat wire C is wound around the core **27**, the edgewise wound coil **50** is manufactured. When the core **27** is removed, the edgewise wound coil **50** is obtained as shown in FIG. **4**.

According to the above described embodiment, the following advantages are obtained.

(1) The edgewise wound coil manufacturing device **11** includes the guide part **37** for guiding the flat wire C such that the flat wire C is wound around the core **27**. The guide part **37** can approach and separate from the core **27** by controlling the operation of the guide part-servomotor **30**. The moving amount of the guide part **37** with respect to the core **27** can appropriately be varied by controlling driving of the guide part-servomotor **30** by the controller **40**. Therefore, when the moving amount of the guide part **37** with respect to the core **27** is adjusted in accordance with a slight difference or the like between materials of the flat wire C, it is possible to prevent the linear part from swelling or being recessed in the edgewise wound coil **50** after the core **27** is removed, and the edgewise wound coil **50** can be manufactured into a desired shape. Hence, to manufacture an edgewise wound coil **50** having a desired shape, it is unnecessary to frequently replace the core **27** in accordance with a factor of material and the like of a flat wire C to be used for manufacturing.

(2) According to the edgewise wound coil manufacturing device **11**, the core **27** can be rotationally supported by the table **21**, and the table **21** can be ascended or descended (moved) by the table-servomotor **15**. Hence, if the core **27** is driven along the center axis L by the table-servomotor **15** while rotating the core **27** by the core-servomotor **23**, it is possible to helically wind the flat wire C around the core **27** such that the flat wire C is superposed in the thickness direction, and it is possible to manufacture a square tubular edgewise wound coil **50**.

(3) According to the edgewise wound coil manufacturing device **11**, the moving amount of the guide part **37** with respect to the core **27** is adjusted so that the flat wire C is bent into a shape conforming to the outside shape of the core **27**. The moving amount of the guide part **37** is adjusted within the range smaller than the depth F of the recess **27***b*. The moving amount of the guide part **37** can easily be controlled by driving the guide part-servomotor **30**, which is controlled by the controller **40**. Therefore, it is possible to manufacture the edgewise wound coil **50** into a desired shape easily without exchanging the core **27**.

(4) The guide member **35** of the guide part **37** guides the flat wire C in a state where the flat wire C is sandwiched in the thickness direction. Hence, it is possible to prevent an inner side (on the core **27** side) of the bent portion of the flat wire C from swelling, and to prevent the flat wire C from falling when the edgewise wound coil **50** is manufactured.

(5) The moving amount of the guide part **37** with respect to the core **27** is adjusted in the range smaller than the depth F of the recess **27***b*. Hence, when the flat wire C is pressed toward the deep side of the recess **27***b*, the flat wire C is not pressed against the core **27** over its entire circumference, and the edgewise wound coil **50** can be manufactured not based on the core **27**, but based on the guide part **37**. In other words, by controlling the moving amount of the guide part **37**, it is possible to manufacture the edgewise wound coil **50** into a desired shape without depending upon the shape of the core **27**. Hence, it is unnecessary to frequently replace the core **27** in accordance with material and the like of the flat wire C.

(6) According to the edgewise wound coil manufacturing device **11**, the core **27** is supported rotationally supported by the table **21**, and the table **21** can be ascended or descended (moved) by the table-servomotor **15**. When the edgewise wound coil **50** is manufactured, the guide part **37**, which is not ascended or descended (moved), winds the flat wire C around the core **27**, which is descended (moved) along the center axis L. Therefore, the flat wire C, which is guided by the guide part **37** is not moved up or down (varied) by the ascending or descending of the guide part **37** unlike the case where the ascending or descending guide part **37** winds the flat wire C around the core **27**, which does not ascend or descend. Hence, if a method of ascending or descending the core **27** along the center axis L is employed instead of vertically moving the guide part **37**, gaps between superposed flat wires C are not varied, and it is possible to accurately wind the flat wire C around the core **27**.

(7) The moving amount of the guide part **37** with respect to the core **27** is adjusted in accordance with the slight difference and the like of materials of the flat wire C. According to this adjustment, it is possible to prevent the linear part from swelling or from being recessed in the edgewise wound coil **50** after the core **27** is removed, and it is possible to manufacture the edgewise wound coil **50** into a desired shape. Therefore, it is possible to omit labor for straightening a swelled part of the obtained edgewise wound coil **50**.

(8) According to the edgewise wound coil manufacturing device **11**, the guide part **37** sandwiches the flat wire C, presses the flat wire C against the core **27** and in this state, the flat wire C is wound around the core **27**, and the edgewise wound coil **50** can be manufactured. In other words, since the guide part **37** (guide member **35**) sandwiches the flat wire C, it is possible to prevent the flat wire C from falling or twisting in the thickness direction when the flat wire C is bent, and the guide part **37** can guide the flat wire C such that flat wire C is helically wound around the core **27** in its axial direction. Further, since the flat wire C is bent along the four angle portions **27***a*, and wound and superposed in the axial direction of the core **27**, it is possible to adjust the moving amount of the guide part **37** with respect to the core **27**. In other words, according to the edgewise wound coil manufacturing device **11**, the flat wire C can be bent in a state where it is reeled up around the core **27**. Hence, the edgewise wound coil manufacturing device **11** does not have a problem that a manufacturing flow is interrupted due to a feeding operation of the flat wire C in contrast to a bender-type device in which a coil is manufactured by repetition of a feeding operation and a bending operation of the flat wire C. Hence, it is possible to shorten the manufacturing time as compared with a case where the edgewise wound coil **50** is manufactured by the bender-type device.

(9) According to the edgewise wound coil manufacturing device **11**, it is possible to bend flat wire C in a state where the flat wire C is reeled up around the core **27**. Therefore, since the feeding operation of the flat wire C as in the bender-type device is not included, vibration of flat wire C generated when the flat wire C is sent is eliminated, and it is possible to avoid a case where the flat wire C receives vibration and the flat wire C becomes large in the thickness direction, and a case where gaps between the superposed flat wires C are varied.

(10) By adjusting the moving amount of the guide part **37** with respect to the core **27**, the flat wire C is formed along the outside shape of the core **27** in a manner that the flat wire C is not pressed against the core **27** over its entire circumference. Hence, it is unnecessary to increase the rigidity of the guide member **35** and the core **27** as compared with a case where the flat wire C formed in a manner that it is pressed against the core **27** over its entire circumference.

(11) The moving amount of the guide part **37** with respect to the core **27** can be adjusted by controlling the operation of the guide part-servomotor **30** by the controller **40**. Hence, by adjusting the moving amount, it is possible to bend the flat wire C in accordance with the angles of the angle portions **27***a* of the core **27**. Therefore, it is possible to bend the flat wire C irrespective of a shape of the core **27**, and to easily manufacture a polygonal edgewise wound coil **50**.

(12) The core **27** includes the four angle portions **27***a* and recesses **27***b* between the pair of adjacent angle portions **27***a*. In other words, each of the side surfaces of the core **27** is recessed inward of the core **27**. A portion of the flat wire C that is opposed to the recess **27***b* is pressed toward the recess **27***b*. Therefore, even if the spring back of the flat wire C is generated after the core **27** is removed, deformation caused by the spring back is canceled by the deformation of the flat wire C caused by being pressed against the recess **27***b*, the linear part of the edgewise wound coil **50** can be formed into a straight line, and a square tubular shape can be maintained.

The above described embodiment may be modified as follows.

In the above embodiment, the table **21** is ascended or descended (moved) by the table-servomotor **15**, the core **27**, which is rotationally supported by the table **21**, is ascended or descended (moved), thereby ascending or descending (moving) the core **27** with respect to the guide part **37** (guide member **35**). Instead of this configuration, the core **27** may only be rotated without ascending or descending (moving) the core **27**, and the guide part **37** (guide member **35**) may be ascended or descended (moved) with respect to the core **27**. In this case, the second moving part ascends or descends (moves) the guide part **37**.

In the above embodiment, the guide part **37** (guide member **35**) is moved in the approaching/receding direction with respect to the core **27**. Instead of this configuration, the core **27** may be moved in the approaching/receding direction with respect to the guide part **37** (guide member **35**) without moving the guide part **37** (guide member **35**). In this case, for example as shown in FIG. **6**, the first moving part moves the core **27** in the approaching/receding direction.

In the above embodiment, the guide part **37** (guide member **35**) moves in the approaching/receding direction with respect to the core **27**. Instead of this configuration, the core **27** and the guide part **37** (guide member **35**) may move in the approaching/receding direction with respect to each other. In this case, the first moving part moves both the core **27** and the guide part **37**.

In the above embodiment, the first moving part of the guide part **37** (guide member **35**) is embodied as the guide part-servomotor **30**. Instead of this, it is possible to use a cam member that abuts against the base end surface of the support arm **34** in a state where the guide member **35** is supported by the distal end of the support arm **34** of the guide part **37**, and is rotationally supported by the table **21**. The guide member **35** may be moved in the approaching/receding direction through the support arm **34** by periodically abutting the cam member against the base end surface of the support arm **34** with rotation of the cam member.

Although the core **27** is of the square pillar shape in the above embodiment, the number of the angles may freely be changed as long as the core **27** is of the polygonal pillar shape. The core **27** may be of the polygonal tubular shape instead of the polygonal pillar shape.

Although the core **27** is of the square pillar shape in the above embodiment, the core **27** does not need to be of the pillar shape. For example, it is possible to use a core formed by rod-like members located at positions where the angle portions of an edgewise wound coil **50** to be manufactured are formed, and recesses formed between adjacent rod-like members.

Although the edgewise wound coil is of the square tubular shape formed by helically winding the flat wire C such that the flat wire C is superposed in the thickness direction in the above embodiment, the present invention can also be applied to an edgewise wound coil in which the flat wire C is only wound less than one turn. In this case, the second moving part, which moves one of the core **27** and the guide part **37** along the center axis L of the core **27**, is unnecessary.

The invention claimed is:

1. An edgewise wound coil manufacturing device for manufacturing an edgewise wound coil, the device comprising:

a core including a plurality of angle portions and recesses each formed between each pair of the adjacent angle portions, wherein a flat wire is wound about the core;

a rotating part configured to rotate the core around a center axis of the core;

a guide part configured to guide the flat wire such that the flat wire is pressed toward a deep side of the recess of the core and wound along the core while sandwiching the flat wire in a thickness direction;

a first moving part configured to move one of the guide part and the core in an approaching/receding direction with respect to the other one of the guide part and the core; and

a controller configured to adjust a moving amount of the first moving part such that the edgewise wound coil is formed into a desired shape, wherein

the controller adjusts the moving amount of the first moving part such that the flat wire moves within a range smaller than a depth of the recess.

2. The edgewise wound coil manufacturing device according to claim **1**, wherein

the edgewise wound coil is formed into a polygonal tubular shape by helically winding the flat wire such that the flat wire is superposed in the thickness direction, and

the edgewise wound coil manufacturing device further includes a second moving part that moves the core along the center axis of the core.

3. The edgewise wound coil manufacturing device according to claim **1**, wherein the first moving part includes a servomotor for moving the guide part in directions approaching and separating from the core.

4. The edgewise wound coil manufacturing device according to claim **1**, wherein the guide part includes a guide member for sandwiching the flat wire, and a support arm for supporting the guide member through a support shaft.

5. The edgewise wound coil manufacturing device according to claim **1**, wherein the approaching/receding direction is perpendicular to a rotational axis of the core.

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